Study on Design and Simulation of Temperature Control System

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Abstract

Temperature control system is nothing but a complicated process which is aimed to maintain the temperature in a particular defined area to a certain maxima or minima level or say defined in a range which is quite certain. We can witness this process commonly used in many parts of the India and many other countries. In recent times, we are witnessing a rapid growth in industries at global level which has led to globalization and industrialization which further has led the necessary use of the temperature control system and its application in these industries at day-to-day level in manufacturing and maintenance with the increase in the greenhouse effect and depletion of ozone layer. Many factories both at small scale as well as at large scale always maintain a certain area or say a section of operation in their infrastructure that must maintain a range of temperature for process to work successfully. The laboratories of research uncertainly sometimes lack in the use of temperature control system which has further necessitated the use of large chambers of different sizes to perform specific temperature related re-search work which further led to the increase in the cost of re-search work. In certain specific areas there are lot of electronic activities happening or some machinery function like in the server rooms or the area where production plant is, so basically these places work constantly for 24hrs and during the whole day the temperature has to be monitored precisely and frequently so that it can be ensured that the temperature do not instantly rise or fall below the marked temperature which may lead to the acceleration of wearing and tearing of whole system. Living rooms, hospitals, malls, aircrafts etc., are also one of the most important places where monitoring of temperature is required so as to ensure that the thermal comfort is ensured, and thermal comfort here means that the state of mind which feels satisfied with the temperature in the present environment. This is important because if there will be any dissatisfaction with the thermal environment then it can cause the body to be too warm or too by unwanted heating and unwanted cooling of the equipment may further lead to the functional disbalance.

Keywords

Green house, Industrialization, LCS, NTC

1. Introduction

Let us go through term word by word by getting what is the actual meaning of the term temperature and control system. There-fore temperature is basically a degree of coldness or say hotness of any equipment or body or say an environment and the term control system here refers to the set of devices or say a single device which has the capability to manage and command or we can say that to regulate the behavior of the surrounding other devices [1]. So therefore, this TCS is nothing but a device or set of many devices connected such that they can manage and command the behavior of other devices so as to ensure that it influences the degree of thermal level of anybody or say any environment. So, we can say that this system is just a quite a programmed system which keep the environment at required temperature without getting disturbed by the whatever the exterior weather conditions are, so it is basically a programmable thermostat. So, if we are having a TCS instead of having a common thermostat then we can notice that it saves both energy and money by automatically maintain the different temperatures at different span of time. Basically, it contains a feedback system which is having a control loop including the sensors who further controls the algorithms and effectors, and they are arranged in such a manner that it try to regulate the things at a reference value [2].

2. Framework of device

The digital device which has the capability to replace the regular thermostat present in the older industries and factories or say homes is known as a programmable thermostat whose primary work is to regulate the temperature of environment by various adjustments. But there is some disadvantage everywhere so here is also a drawback that these traditional thermostats are left at a single setting coming out of the sheer convenience [3]. The most interesting part and efficient part is that it knows that when you are need of this system and you are not so accordingly it could adjust the thermal comfort and save energy instantly. This is what this system is offering to us.
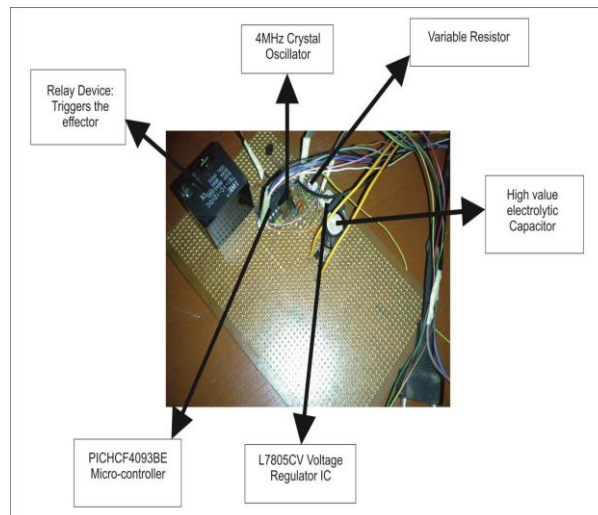

Figure 1. Circuit Diagram

This system basically consists of a small programmable digital logic controller device which is further wired to a heating or cooling system as per the requirements and considering the small size of a normal wall mounted thermostat the system contains a small circuit board and a memory chip. When the desired temperature is set commonly known as the set point the system will further use the heater or the air conditioning unit as effectors so as to ensure the maintained setting programmed

[6]. An electronic device which is used for the automation of industrial processes like controlling the machinery part of the factory assembly lines. Here the output must be produced in accordance with the input variables in each span of time therefore it is an example of real time system and is called as a collection of relays in series.

3. System Design and Analysis

This part manages the course of action and appraisal of this Temperature Control System and reveals more understanding into how the variable force supply is produced and other different bits of the structure and their various parts [4].

3.1. Power Supply Unit

All stages in the design require a +12volts DC supply with the exception of the microcontroller and the sensor ICs which re-quire a +5volts supply. Likewise, a settled DC voltage is needed for the microcontroller and the sensor LCS. The framework utilized is to create a prompt force supply which wires a 12v advancement down transformer, a stage rectifier, channel capacitor, and a 5volts voltage controller of positive yield kind [5].

3.2. Temperature Sensing Unit

This unit resources or sees the temp in a specified area. The unit consolidates a mud Negative Temp Coefficient Thermally Sensitive Resistor (NTC Thermistor). Such a temp sensor shows a decreasing in electrical avoidance with creating temp. It is a semi-conductor-based soil contraption [7]. It overall has a functioning temperature level of – 50°C to +150°C and is undeniable to ±0.1°C.
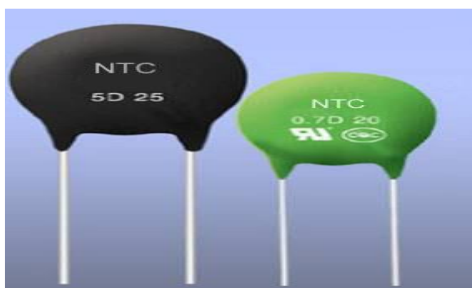

Figure 2. NTC Resistors

3.3. Temperature Control Unit

This unit gauges the temp perceived by the NTC THERMISTOR IC and controls the generally speaking development of the construction. It contains an ATMEL AT89C52 microcontroller IC which contains a non-precarious FLASH program memory that is identical programmable.

3.4. Switching Circuit

The yield from the more unassuming than ordinary controller pin 24 triggers the trading circuit. The sign is gone through a MOSFET. The Metal–Oxide–Semiconductor Field-Effect Semiconductor (MOSFET) is a semiconductor used for overhauling or trading electronic signs. The essential norm of such a semiconductor relies on the way that a voltage on the oxide insulated entrance terminal can incite an essential channel between the two exceptional contacts called source and channel.

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3.5. System Alarm Unit

This incorporates basically of a ringer or a mourner arranged sounder. A ringer is a hailing contraption, generally electronic, dependably used in vehicles, neighborhood contraptions like microwaves, or then again obviously game describes to pass alerts on structure events.

4. System Design Model

The Design Model utilized in the orchestrating of this specific framework is the on / off Control Model. As clarified in Chapter One, utilizing this method recommends that the yield from the contraption is only on or off, with any excentre state/position. An on-off regulator effector the yield precisely when the temp crosses the reference value. For warming control, the yield is on right when the temperature is under the reference value and off over the top point, and the converse path around for cooling control. As the temp crosses the set-highlight change the yield express, the measure temperature will cycle relentlessly, going from under the set-highlight above, and back under.

5. Conclusion

PID Controller Algorithms are viewed as the most proficient and mind boggling of all control Algorithms having feasibly vanquished the blocks of both the on/off Control also, the Proportional Control Algorithms. In any case, even with its ability and adequacy, we can in any case several limits clear in its control structure. What by then is the issue? The critical issue lies with the subordinate term: this is a consequence of the way that little extents of evaluation or correspondence uproar can cause a huge load of progress in the yield. Hence, a low-pass channel can be utilized to forgo higher-rehash bang parts. In any case, low pass sifting and subordinate control can adjust one another, so reducing commotion by instrumentation means can be viewed as an endlessly improved decision. Then again, a nonlinear focus channel might be utilized, which improves the confining sufficiency and traditional execution.

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